In the Claims

The following Listing of Claims replaces all prior versions in the application:

LISTING OF CLAIMS

The following Listing of Claims replaces all prior versions in the application:

1.- 83. (Canceled)

84. (Currently Amended) A remote unit modem to transmit digital data upstream to a headend modem comprising:

a digital data receiver for receiving downstream digital data transmitted from ~~a~~said headend modem modulated by ~~any~~a modulation scheme, said downstream digital data either encoding a master clock generated at said headend modem in payload data or other data, said master clock being used to transmit said downstream data, or said downstream data including said master clock as well as payload data, said digital data receiver functioning to recover said downstream payload data and said master clock and generating an upstream clock from said recovered master clock;

a digital data transmitter for coupling to a source of upstream digital payload data from one or more sources, and coupled to receive said upstream clock generated from said recovered master clock and using said upstream clock to transmit known preamble data and, subsequently, transmitting said upstream ~~payload~~ digital payload data using ~~any~~a modulation method, and, if necessary to separate upstream payload data from several upstream data sources, using ~~any~~a multiplexing method,

wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from downstream frame marker data transmitted to mark the beginning of every downstream frame, said

downstream frame marker data encoding said master clock, and wherein said receiver or transmitter includes means to recover data transmitted by said headend modem from which a frame marker can be generated such that said downstream frames can be counted by said remote unit modem, and wherein said transmitter and/or receiver includes means for counting received downstream frames and for counting upstream frames transmitted by said remote unit modem, and for carrying out ranging by receiving a frame from said headend modem having any frame number and responding by sending back a response frame which includes a total turnaround time service request and the frame number of the downstream frame just received, and for receiving back a frame which includes the total turnaround time for said remote unit modem in the form of the difference between the headend modem's downstream frame count at the time said response frame is received and the downstream frame number included in the response frame, and said transmitter including means for using said total turnaround time along with spreading code assignments transmitted to said remote unit modem from said headend modem so as to use the proper spreading codes to spread the spectrum of data during specific upstream frames.

85. (Currently Amended) The apparatus of claim 84 wherein said upstream payload data is organized as frames, and further comprising means in said transmitter for carrying out a ranging process prior to transmitting said upstream payload data to determine a value for an upstream frame timing delay which is used to transmit each upstream frame from ~~this~~the transmitter which will cause said upstream frame to arrive at said headend modem with its frame boundaries aligned in time with upstream frames transmitted from other remote unit modem transmitters.

86. (Previously Presented) The apparatus of claim 85 wherein said transmitter includes a precode filter and receives upstream payload data from different sources and code division multiplexes data from each source using different spreading codes from an orthogonal, cyclic code set, and further comprising means for performing equalization training after frame synchronization has been achieved so as to determine coefficients to set into said precode filter to predistort transmissions from said transmitter to reduce or eliminate channel distortion.

87. (Currently Amended) The apparatus of claim 86 wherein said means for performing equalization training further comprises means for checking the accuracy of frame synchronization and adjusting said ~~transmit~~upstream frame timing delay if necessary.

88. (Currently Amended) The apparatus of claim 86 wherein said means for performing equalization training further comprises means for adjusting the power level of transmissions from ~~this~~the transmitter to achieve power alignment such that transmissions from ~~this~~the transmitter arrive at said headend modem at approximately the same power level as transmissions from remote unit modems.

89. (Currently Amended) The apparatus of claim 87 wherein said transmitter includes a quadrature amplitude modulation modulator to use QAM modulation to transmit said upstream payload data, and wherein said means for performing equalization training further comprises means for adjusting the power level of transmissions from ~~this~~the transmitter to achieve power alignment such that transmissions from ~~this~~the transmitter arrive at said headend modem at approximately the same power level as transmissions from remote unit modems.

90. (Previously Presented) The apparatus of claim 84 wherein said transmitter includes shaping filters which have transfer functions which are the Hilbert transfer function of each other so as to filter upstream transmissions to achieve carrierless modulation.

91. (Previously Presented) The apparatus of claim 90 wherein said shaping filters have transfer functions so as to filter upstream transmissions to limit their bandwidth to 6 MHz centered around a center frequency.

92. (Previously Presented) The apparatus of claim 90 wherein said shaping filters have squared raised cosine filter transfer functions so as to filter upstream transmissions to satisfy the Nyquist criteria to optimize signal-to-noise enhancement and minimize intersymbol interference.

93. (Previously Presented) The apparatus of claim 90 wherein said shaping filters are digital and programmable so as to have adjustable filter transfer functions so as to filter upstream transmissions to satisfy the Nyquist criteria to optimize signal-to-noise enhancement and minimize intersymbol interference.

94. (Previously Presented) The apparatus of claim 84 wherein said transmitter receives upstream payload data from multiple sources and includes a code division multiplexer which functions to code division multiplex data from each source using different spreading codes from a spreading code set.

95. (Currently Amended) The apparatus of claim 84:

wherein said remote unit modem is one of a plurality of remote unit modems all of which share a common upstream data path to transmit data to said headend modem in frames,

and wherein said~~and wherein said~~ transmitter in said remote unit modem functions to receive upstream payload data from multiple sources and transmit ~~said upstream payload data~~same in frames,

and wherein said transmitter further comprises ranging means for determining a transmit frame timing delay which, when imposed, causes each upstream transmitted frame to arrive at said headend modem with its frame boundaries aligned in time with the frame boundaries of other upstream payload data frames transmitted from said other remote unit modems,

and wherein said transmitter includes a code division multiplexer which functions to code division multiplex upstream payload data from each source using different spreading codes from a spreading code set.

96. (Previously Presented) he apparatus of claim 84:

werein said remote unit modem is one of a plurality of remote unit modems all of which share a common upstream data path to transmit data to said headed modem in frames,

and wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from downstream frame marker data transmitted to mark the beginning of every downstream frame, said downstream frame marker encoding said master clock;

and wherein said transmitter in said remote unit modem functions to receive upstream payload data from multiple sources and transmit said upstream payload data in frames,

and wherein said transmitter further comprises ranging means for determining a transmit frame timing delay which, when imposed, causes each upstream transmitted frame to arrive at said headend modem with its frame boundaries aligned in time with the frame boundaries of other upstream payload data frames transmitted from said other remote unit modems.

97. (Currently Amended) The apparatus of claim 96 wherein said downstream frame marker is a barker code or any other signal ~~with good~~having autocorrelation properties meeting or exceeding a predetermined autocorrection level.

98. (Previously Presented) The apparatus of claim 96 wherein said transmitter includes circuitry to generate an upstream carrier from said recovered master clock which is of the same frequency as a downstream carrier used by said headend modem to transmit downstream payload data, and wherein said transmitter includes means to modulate said upstream payload data onto said upstream carrier for transmission.

99. (Previously Presented) The apparatus of claim 84 wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from downstream frame marker data transmitted to mark the beginning of every downstream frame, said downstream frame marker encoding said master clock.

100. (Currently Amended) The apparatus of claim 84 wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from pilot channel data transmitted on a downstream management and control channel, and wherein said transmitter or said receiver includes circuitry to either recover a master clock used to transmit downstream payload data from said pilot channel data and synchronize an upstream carrier to said recovered master ~~carrier~~clock or use said recovered master clock to generate an upstream carrier which is phase coherent therewith.

101. (Currently Amended) The apparatus of claim 84 wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from downstream frame marker data transmitted to mark the beginning of every downstream frame, said downstream frame marker data encoding said master clock, and wherein said receiver or transmitter includes means to generate an upstream carrier from said recovered master clock, and wherein said downstream frame marker data is any signal ~~which has good~~having autocorrelation properties meeting or exceeding a predetermined autocorrection level including a barker code.

102. (Canceled)

103. (Currently Amended) The apparatus of claim 84 wherein said transmitter comprises:

a framer circuit functioning to receive said ~~multiple streams of said~~upstream digital ~~upstream~~ payload data as input streams from the one or more sources and interleave ~~said data~~same into a plurality of frames, said framer circuit outputting one or more information vectors per frame, said information vectors containing data from said input streams of digital upstream payload data;

a code division multiple access multiplexer circuit functioning to receive said information vectors and spread the Fourier spectrum thereof using orthogonal spreading codes to perform a coding transformation so as to generate one or more symbols from each information vector having a spread power spectrum;

a modulator for using said one or more symbols to modulate one or more radio frequency carriers for transmission to said headend modem.

104. (Currently Amended) The apparatus of claim 84 wherein said transmitter comprises:

a framer circuit functioning to receive said ~~multiple streams of said~~upstream digital ~~upstream~~ payload data as input streams from one or more sources and interleave ~~said data~~same into a plurality of frames, said framer circuit outputting one or more

information vectors per frame, said information vectors containing data from said, input streams of ~~digital~~ upstream digital payload data organized as individual elements, each element comprised of a plurality of bits;

a trellis encoder coupled to receive said information vectors and trellis encode each element to add redundant bits that can be used at said headend modem to recover said data elements and correct for reception errors caused by channel impairments, said trellis encoder outputting trellis encode information vectors including real and imaginary information vectors;

a code division multiple access multiplexer circuit functioning to receive said trellis encoded information vectors and spread the Fourier spectrum thereof using orthogonal spreading codes to perform a coding transformation so as to generate one or more symbols from each trellis encoded information vector having a spread power spectrum; and

a carrierless shaping filter modulator comprised of a first filter to passband filter the spread spectrum resulting from code division multiplexing of said real information vectors to pass only a first passband of predetermined limited bandwidth and center frequency and further comprised of a second filter having a filter transfer function which is the Hilbert transform of the transfer function of said first filter and functioning to passband filter the spread spectrum resulting from code division multiplexing of said imaginary information vectors to pass only a first passband of predetermined limited bandwidth and center frequency.

105. (Currently Amended) The apparatus of claim 104 further comprising means in said receiver and said transmitter for receiving code assignment messages from said headend modem specifying which particular spreading codes are to be used at specific times, and for controlling said code division multiple access multiplexer circuit to use the assigned spreading codes at the assigned times.

106. (Canceled)

107. (Previously Presented) The apparatus of claim 84 wherein said transmitter includes means for receiving one or more input streams of upstream data which may be on separate conductors or in separate timeslots of a time division multiplexed stream, and for interleaving data from different streams in the same stream into each of a plurality of elements of one or more information vectors, and wherein said transmitter further comprises means for encoding each element of each information vector with a predetermined number of error correction bits.

108. (Previously Presented) The apparatus of claim 84 wherein said transmitter includes means for receiving one or more input streams of upstream data which may be on separate conductors or in separate timeslots of a time division multiplexed stream, and for interleaving data from different streams or from different times in the same stream into each of a plurality of elements of one or more information vectors.

109. (Currently Amended) The apparatus of claim 84 wherein said transmitter includes ~~comprises~~ means for encoding each element of ~~each information vector~~upstream digital payload data from at least one of the one or more sources with a predetermined number of error correction bits.

110. (Previously Presented) The apparatus of claim 84 wherein said remote unit modem includes a code division multiplexer and means for implementing code diversity.

111. (Currently Amended) The apparatus of claim ~~102~~ 84 wherein said digital data transmitter is a spread spectrum transmitter, and wherein said receiver further comprises means to recover downstream code allocation messages transmitted by said headend modem that define which spreading codes are to be used by said remote unit modem during particular upstream frames, and wherein said transmitter further comprises means for using the assigned spreading codes to spread the spectrum of ~~said~~ upstream data during the upstream frames designated in said downstream code allocation messages.

112. – 131. (Canceled)

132. (Currently Amended) A process of bidirectional digital data communication carried out by remote unit modem to exchange digital data transmissions with a headend modem comprising the steps of:

receiving downstream digital data transmitted in frames from ~~a~~said headend modem modulated by ~~any~~a modulation scheme;

recovering said downstream payload data and a master clock encoded in a downstream frame marker signal;

presenting said downstream data at an output;

receiving upstream digital payload data having a first clock rate from one or more sources;

organizing upstream digital payload data into upstream frames of the same length as said downstream frames;

transmitting a ranging signal at various trial and error transmit frame timing delay values;

receiving messages back from said headend modem that are used to adjust said transmit frame timing delay value until a value is found which causes frame synchronization to exist, frame synchronization being defined as the arrival of upstream frames at said headend modem with their frame boundaries aligned in time with the frame boundaries of upstream frames transmitted from other remote unit modems to said head end modem;

generating a chip clock that is phase coherent with said recovered master clock and at a much higher rate than said first clock rate;

generating an upstream carrier that is phase coherent with said recovered master clock;

using said chip clock to multiply one or more orthogonal spreading codes times the upstream data in one or more upstream frames to generate one or more upstream frames of upstream spread spectrum payload data;

transmitting said frames of upstream spread spectrum payload digital data using ~~any~~a modulation method and said upstream carrier, and using the transmit frame timing delay in transmitting each upstream frame which caused frame synchronization to exist;

interleaving upstream payload data to form one or more information vectors for each upstream frame;

Trellis encoding each element of said information vectors with redundant error detection and correction bits;

mapping the resulting bits into real and imaginary components of constellation points to generate real and imaginary information vectors from each said information vectors, each said real and imaginary information vector comprised of the same number of elements as there were elements in the information vector from which it was generated;

multiplying said elements of said real and imaginary information vectors by one or more said orthogonal, cyclic spreading codes at the chip clock rate times to generate real and imaginary result vectors each comprised of a plurality of chips;

using said chips of said real and imaginary result vectors to generate upstream signals to transmit using carrierless quadrature amplitude modulation; and

transmitting said upstream signals to said headend modem over a cable television hybrid fiber coaxial cable transmission medium which is simultaneously carrying downstream analog cable television signals and downstream digital data without interfering therewith by using frequency division multiplexing between said upstream and said downstream.

133. (Currently Amended) The process of claim 132 further comprising the steps of:

~~from time to time,~~ checking the continued accuracy of the frame synchronization; and

cooperating with said head end modem to adjust said frame synchronization when necessary;

cooperating with said head end modem to adjust the power level of transmissions by said remote unit modem such that transmissions therefrom arrive at said head end modem at approximately the same power level as transmissions from other remote unit modems; and

cooperating with said head end modem to adjust filter coefficients ~~in said upstream transmitter~~ to predistort upstream data transmissions to compensate for upstream channel impairments.

134. (Currently Amended) The process of claim 132 further comprising the step of interleaving said upstream digital payload data over time to form a plurality of information vectors for each upstream frame, each information vector comprised of a plurality of elements, each element comprised of one or more bits of said upstream digital payload data.

135. (Previously Presented) The process of claim 133 further comprising the step of interleaving said upstream payload data over time to form a plurality of information vectors for each upstream frame, and Trellis encoding each element to add redundant error correction bits and map each element into corresponding inphase and quadrature elements of corresponding inphase and quadrature information vectors and code division multiplexing each inphase and quadrature information vector.

136. (Previously Presented) The process of claim 132 wherein the step of organizing upstream digital payload data into upstream frames of the same length as said downstream frames further comprising the steps of organizing each said upstream frame as one or more information vectors and encoding said information vectors with error detection and correction bits.

137. (Currently Amended) The process of claim 135 wherein the step of using said chip clock to multiply one or more orthogonal spreading codes times the upstream data in one or more upstream frames comprises code division multiplexing each of said inphase and quadrature information vectors to generate inphase and quadrature result vectors, and wherein said step of transmitting said frames of upstream spread spectrum payload digital data using ~~any~~a modulation

method comprises the steps of using said inphase and quadrature result vectors to set the information content of two quadrature amplitude modulated radio frequency signals formed by carrierless modulation using two shaping filters having filter transfer functions which are the Hilbert transform of one another.

138. – 143. (Canceled)

144. (New) A remote unit modem to transmit digital data upstream to a headend modem comprising:

a digital data receiver for receiving downstream digital data transmitted from said headend modem modulated by a modulation scheme, said downstream digital data either encoding a master clock generated at said headend modem in payload data or other data, said master clock being used to transmit said downstream data, or said downstream data including said master clock as well as payload data, said digital data receiver functioning to recover said downstream payload data and said master clock and generating an upstream clock from said recovered master clock;

a digital data transmitter for coupling to a source of upstream digital payload data from one or more sources, and coupled to receive said upstream clock generated from said recovered master clock and using said upstream clock to transmit known preamble data and, subsequently, transmitting said upstream payload digital data using a modulation method, and, if necessary to separate upstream payload data from several upstream data sources, using a multiplexing method;

a framer circuit functioning to receive said upstream digital payload data as input streams from one or more sources and interleave same into a plurality of frames, said framer circuit outputting one or more information vectors per frame, said information vectors containing data from said input streams of upstream digital payload data organized as individual elements, each element comprised of a plurality of bits;

a trellis encoder coupled to receive said information vectors and trellis encode each element to add redundant bits that can be used at said headend modem to recover

said data elements and correct for reception errors caused by channel impairments, said trellis encoder outputting trellis encode information vectors including real and imaginary information vectors;

a code division multiple access multiplexer circuit functioning to receive said trellis encoded information vectors and spread the Fourier spectrum thereof using orthogonal spreading codes to perform a coding transformation so as to generate one or more symbols from each trellis encoded information vector having a spread power spectrum; and

a carrierless shaping filter modulator comprised of a first filter to passband filter the spread spectrum resulting from code division multiplexing of said real information vectors to pass only a first passband of predetermined limited bandwidth and center frequency and further comprised of a second filter having a filter transfer function which is the Hilbert transform of the transfer function of said first filter and functioning to passband filter the spread spectrum resulting from code division multiplexing of said imaginary information vectors to pass only a first passband of predetermined limited bandwidth and center frequency.

145. (New) The apparatus of claim 144 wherein said upstream payload data is organized as frames, and further comprising means in said transmitter for carrying out a ranging process prior to transmitting said upstream payload data to determine a value for an upstream frame timing delay which is used to transmit each upstream frame from the transmitter which will cause said upstream frame to arrive at said headend modem with its frame boundaries aligned in time with upstream frames transmitted from other remote unit modem transmitters.

146. (New) The apparatus of claim 145 wherein said transmitter includes a precode filter and receives upstream payload data from different sources and code division multiplexes data from each source using different spreading codes from an orthogonal, cyclic code set, and further comprising means for performing equalization training after frame synchronization has been achieved so as to determine coefficients to set into said precode filter to predistort transmissions from said transmitter to reduce or eliminate channel distortion.

147. (New) The apparatus of claim 146 wherein said means for performing equalization training further comprises means for checking the accuracy of frame synchronization and adjusting said upstream frame timing delay if necessary.

148. (New) The apparatus of claim 146 wherein said means for performing equalization training further comprises means for adjusting the power level of transmissions from the transmitter to achieve power alignment such that transmissions from the transmitter arrive at said headend modem at approximately the same power level as transmissions from remote unit modems.

149. (New) The apparatus of claim 147 wherein said transmitter includes a quadrature amplitude modulation modulator to use QAM modulation to transmit said upstream payload data, and wherein said means for performing equalization training further comprises means for adjusting the power level of transmissions from the transmitter to achieve power alignment such that transmissions from the transmitter arrive at said headend modem at approximately the same power level as transmissions from remote unit modems.

150. (New) The apparatus of claim 144 wherein said transmitter includes shaping filters which have transfer functions which are the Hilbert transfer function of each other so as to filter upstream transmissions to achieve carrierless modulation.

151. (New) The apparatus of claim 150 wherein said shaping filters have transfer functions so as to filter upstream transmissions to limit their bandwidth to 6 MHz centered around a center frequency.

152. (New) The apparatus of claim 150 wherein said shaping filters have squared raised cosine filter transfer functions so as to filter upstream transmissions to satisfy the Nyquist criteria to optimize signal-to-noise enhancement and minimize intersymbol interference.

153. (New) The apparatus of claim 150 wherein said shaping filters are digital and programmable so as to have adjustable filter transfer functions so as to filter upstream

transmissions to satisfy the Nyquist criteria to optimize signal-to-noise enhancement and minimize intersymbol interference.

154. (New) The apparatus of claim 144 wherein said transmitter receives upstream payload data from multiple sources and includes a code division multiplexer which functions to code division multiplex data from each source using different spreading codes from a spreading code set.

155. (New) The apparatus of claim 144:

wherein said remote unit modem is one of a plurality of remote unit modems all of which share a common upstream data path to transmit data to said headend modem in frames,

and wherein said transmitter in said remote unit modem functions to receive upstream payload data from multiple sources and transmit same in frames,

and wherein said transmitter further comprises ranging means for determining a transmit frame timing delay which, when imposed, causes each upstream transmitted frame to arrive at said headend modem with its frame boundaries aligned in time with the frame boundaries of other upstream payload data frames transmitted from said other remote unit modems,

and wherein said transmitter includes a code division multiplexer which functions to code division multiplex upstream payload data from each source using different spreading codes from a spreading code set.

156. (New) he apparatus of claim 144:

werein said remote unit modem is one of a plurality of remote unit modems all of which share a common upstream data path to transmit data to said headed modem in frames,

and wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said

master clock from downstream frame marker data transmitted to mark the beginning of every downstream frame, said downstream frame marker encoding said master clock;

and wherein said transmitter in said remote unit modem functions to receive upstream payload data from multiple sources and transmit said upstream payload data in frames,

and wherein said transmitter further comprises ranging means for determining a transmit frame timing delay which, when imposed, causes each upstream transmitted frame to arrive at said headend modem with its frame boundaries aligned in time with the frame boundaries of other upstream payload data frames transmitted from said other remote unit modems.

157. (New) The apparatus of claim 156 wherein said downstream frame marker is a barker code or any other signal having autocorrelation properties meeting or exceeding a predetermined autocorrection level.

158. (New) The apparatus of claim 156 wherein said transmitter includes circuitry to generate an upstream carrier from said recovered master clock which is of the same frequency as a downstream carrier used by said headend modem to transmit downstream payload data, and wherein said transmitter includes means to modulate said upstream payload data onto said upstream carrier for transmission.

159. (New) The apparatus of claim 144 wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from downstream frame marker data transmitted to mark the beginning of every downstream frame, said downstream frame marker encoding said master clock.

160. (New) The apparatus of claim 144 wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from pilot channel data transmitted on a downstream management and control channel, and wherein said transmitter or said receiver includes circuitry to either recover a master clock used to transmit downstream payload data from said pilot channel data and

synchronize an upstream carrier to said recovered master clock or use said recovered master clock to generate an upstream carrier which is phase coherent therewith.

161. (New) The apparatus of claim 144 wherein said digital data receiver receives downstream payload data transmitted in frames from said headend modem and includes means to recover said master clock from downstream frame marker data transmitted to mark the beginning of every downstream frame, said downstream frame marker data encoding said master clock, and wherein said receiver or transmitter includes means to generate an upstream carrier from said recovered master clock, and wherein said downstream frame marker data is any signal having autocorrelation properties meeting or exceeding a predetermined autocorrection level including a barker code.

162. (New) The apparatus of claim 144 wherein said transmitter comprises:

a framer circuit functioning to receive said upstream digital payload data as input streams from the one or more sources and interleave same into a plurality of frames, said framer circuit outputting one or more information vectors per frame, said information vectors containing data from said input streams of digital upstream payload data;

a code division multiple access multiplexer circuit functioning to receive said information vectors and spread the Fourier spectrum thereof using orthogonal spreading codes to perform a coding transformation so as to generate one or more symbols from each information vector having a spread power spectrum;

a modulator for using said one or more symbols to modulate one or more radio frequency carriers for transmission to said headend modem.

163. (New) The apparatus of claim 144 further comprising means in said receiver and said transmitter for receiving code assignment messages from said headend modem specifying which particular spreading codes are to be used at specific times, and for controlling said code division multiple access multiplexer credit to use the assigned spreading codes at the assigned times.

164. (New) The apparatus of claim 144 wherein said transmitter includes means for receiving one or more input streams of upstream data which may be on separate conductors or in separate timeslots of a time division multiplexed stream, and for interleaving data from different streams in the same stream into each of a plurality of elements of one or more information vectors, and wherein said transmitter further comprises means for encoding each element of each information vector with a predetermined number of error correction bits.

165. (New) The apparatus of claim 144 wherein said transmitter includes means for receiving one or more input streams of upstream data which may be on separate conductors or in separate timeslots of a time division multiplexed stream, and for interleaving data from different streams or from different times in the same stream into each of a plurality of elements of one or more information vectors.

166. (New) The apparatus of claim 144 wherein said transmitter includes means for encoding each element of upstream digital payload data from at least one of the one or more sources with a predetermined number of error correction bits.

167. (New) The apparatus of claim 144 wherein said remote unit modem includes a code division multiplexer and means for implementing code diversity.

168. (New) A process of bidirectional digital data communication carried out by remote unit modem to exchange digital data transmissions with a headend modem comprising the steps of:

receiving downstream digital data transmitted in frames from said headend modem modulated by a modulation scheme;

recovering said downstream payload data and a master clock encoded in a downstream frame marker signal;

presenting said downstream data at an output;

receiving upstream digital payload data having a first clock rate from one or more sources;

organizing upstream digital payload data into upstream frames of the same length as said downstream frames;

transmitting a ranging signal at various trial and error transmit frame timing delay values;

receiving messages back from said headend modem that are used to adjust said transmit frame timing delay value until a value is found which causes frame synchronization to exist, frame synchronization being defined as the arrival of upstream frames at said headend modem with their frame boundaries aligned in time with the frame boundaries of upstream frames transmitted from other remote unit modems to said head end modem;

generating a chip clock that is phase coherent with said recovered master clock and at a much higher rate than said first clock rate;

generating an upstream carrier that is phase coherent with said recovered master clock;

using said chip clock to multiply one or more orthogonal spreading codes times the upstream data in one or more upstream frames to generate one or more upstream frames of upstream spread spectrum payload data;

transmitting said frames of upstream spread spectrum payload digital data using a modulation method and said upstream carrier, and using the transmit frame timing delay in transmitting each upstream frame which caused frame synchronization to exist;

checking the continued accuracy of the frame synchronization; and

cooperating with said head end modem to adjust said frame synchronization when necessary;

cooperating with said head end modem to adjust the power level of transmissions by said remote unit modem such that transmissions therefrom arrive at said head end modem at approximately the same power level as transmissions from other remote unit modems;

cooperating with said head end modem to adjust filter coefficients to predistort upstream data transmissions to compensate for upstream channel impairments; and

interleaving said upstream payload data over time to form a plurality of information vectors for each upstream frame, and Trellis encoding each element to add redundant error correction bits and map each element into corresponding inphase and quadrature elements of corresponding inphase and quadrature information vectors and code division multiplexing each inphase and quadrature information vector,

wherein using said chip clock to multiply one or more orthogonal spreading codes times the upstream data in one or more upstream frames comprises code division multiplexing each of said inphase and quadrature information vectors to generate inphase and quadrature result vectors, and wherein said step of transmitting said frames of upstream spread spectrum payload digital data using a modulation method comprises the steps of using said inphase and quadrature result vectors to set the information content of two quadrature amplitude modulated radio frequency signals formed by carrierless modulation using two shaping filters having filter transfer functions which are the Hilbert transform of one another.

169. (New) The process of claim 168 further comprising the step of interleaving said upstream digital payload data over time to form a plurality of information vectors for each upstream frame, each information vector comprised of a plurality of elements, each element comprised of one or more bits of said upstream digital payload data.

170. (New) The process of claim 168 wherein the step of organizing upstream digital payload data into upstream frames of the same length as said downstream frames further comprising the steps of organizing each said upstream frame as one or more information vectors and encoding said information vectors with error detection and correction bits.